FIG.1

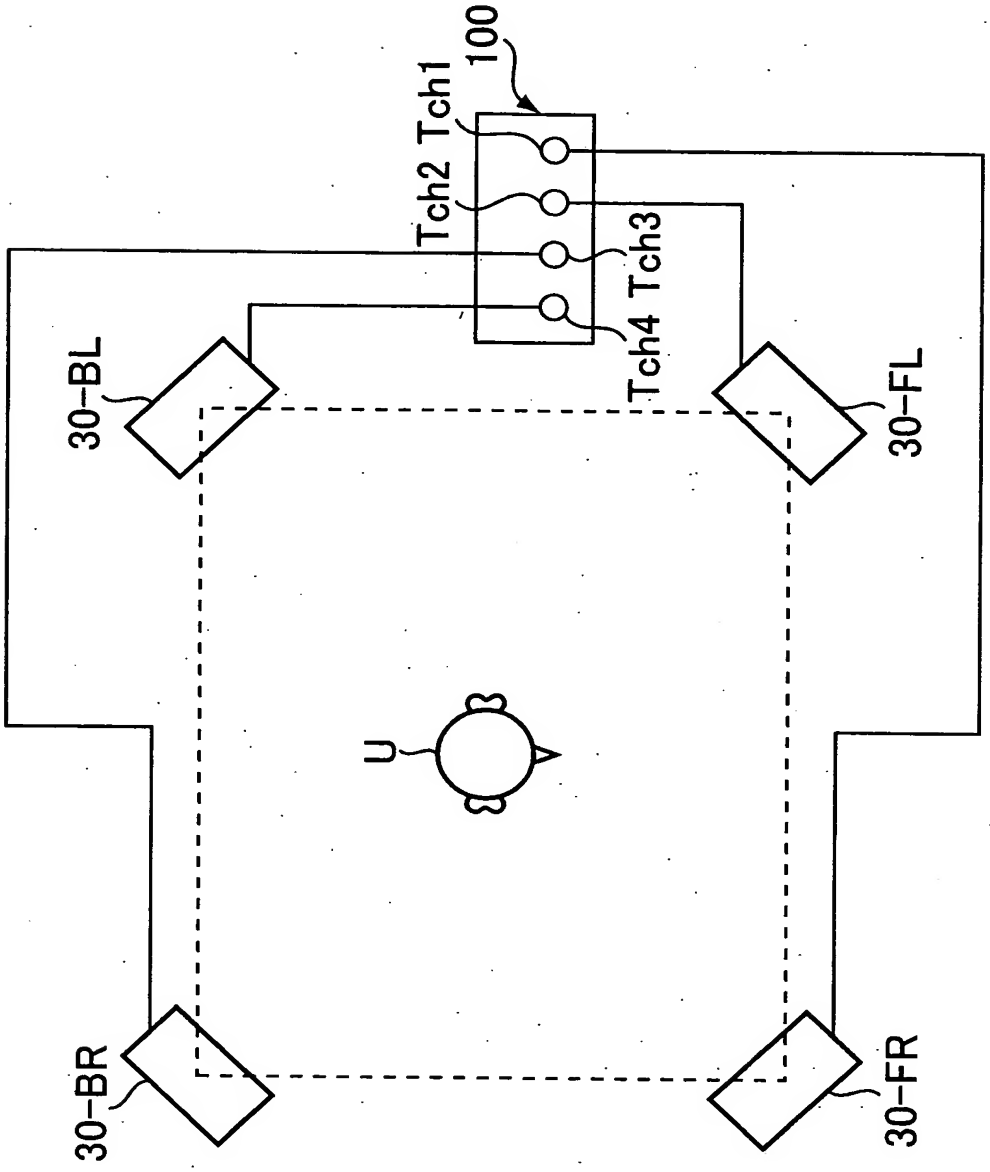


FIG.2

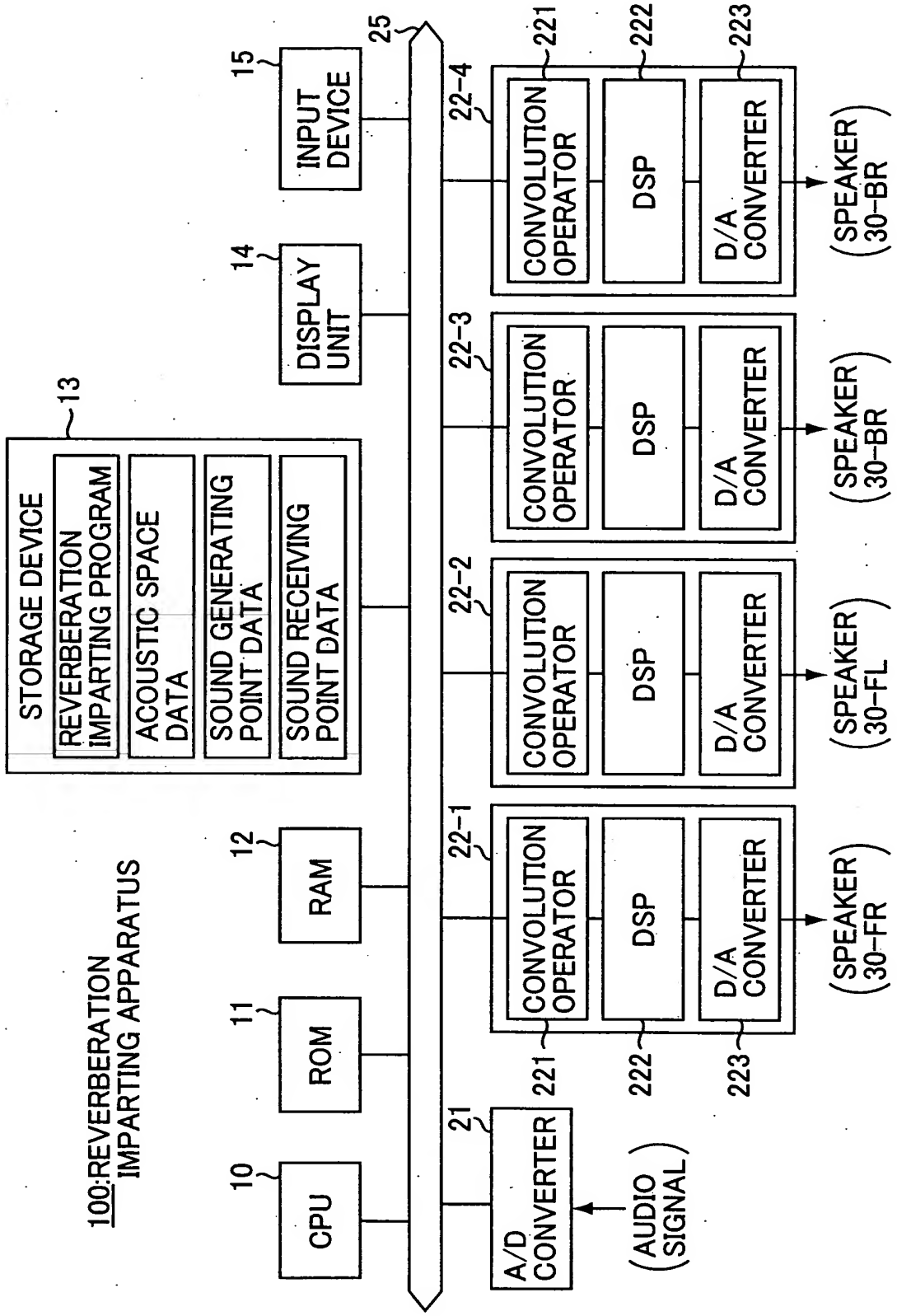

100:REVERBERATION IMPARTING APPARATUS
CPU
10
ROM
11
RAM
12
STORAGE DEVICE
13
REVERBERATION IMPARTING PROGRAM
ACOUSTIC SPACE DATA
SOUND GENERATING POINT DATA
SOUND RECEIVING POINT DATA
DISPLAY UNIT
14
INPUT DEVICE
15
25
A/D CONVERTER
21
(AUDIO SIGNAL)
22-1
22-2
22-3
22-4
CONVOLUTION OPERATOR
221
DSP
222
D/A CONVERTER
223
(SPEAKER 30-FR)
(SPEAKER 30-FL)
(SPEAKER 30-BR)
(SPEAKER 30-BR)

FIG.3 (a)

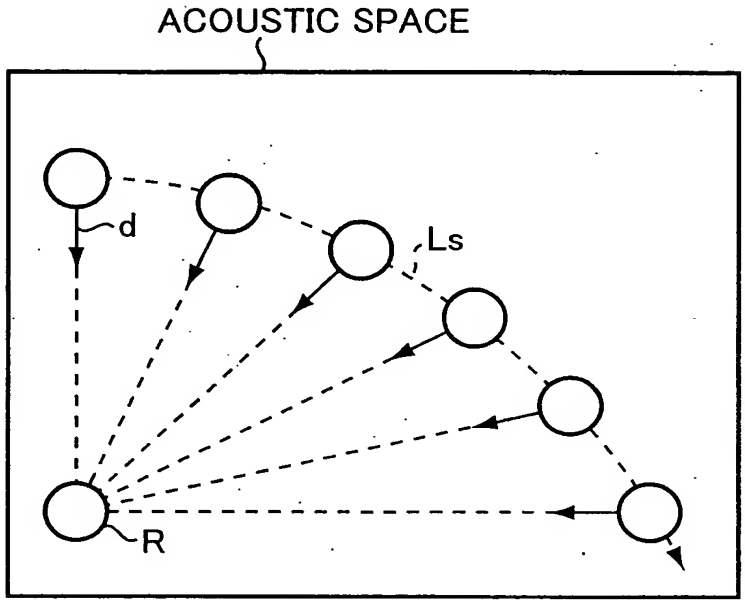


FIG.3 (b)

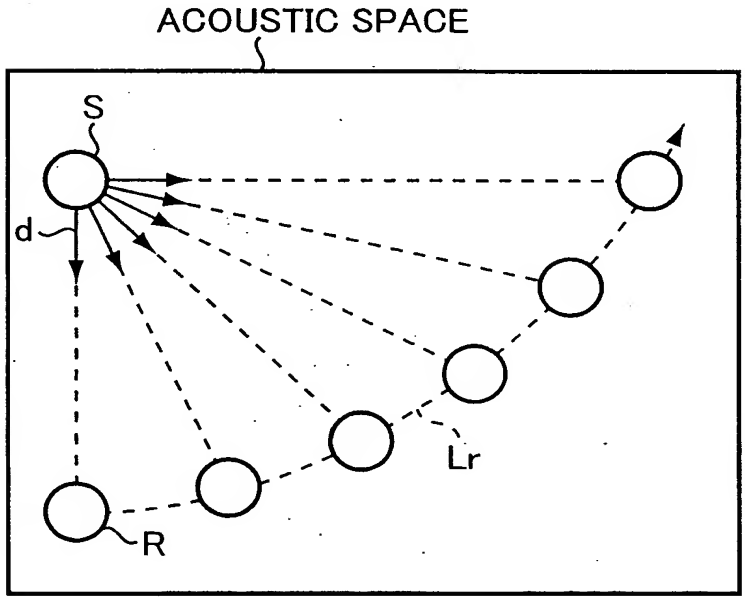


FIG.4 (a)

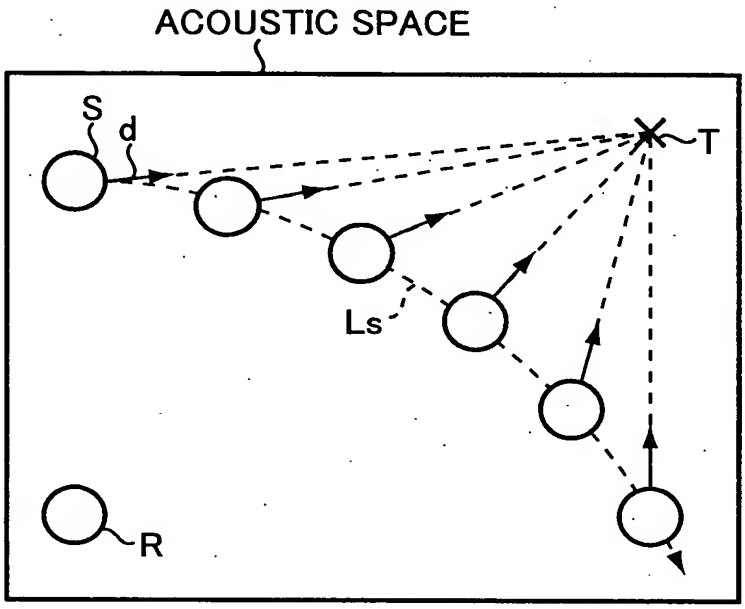


FIG.4 (b)

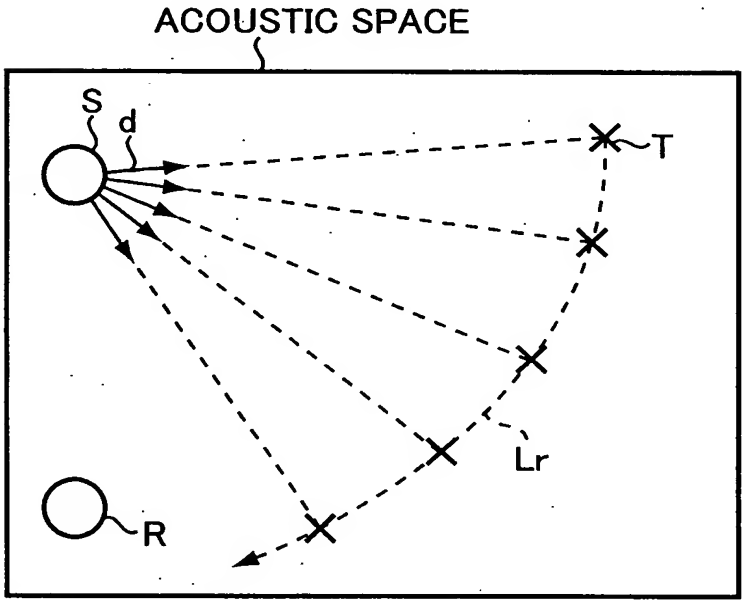


FIG.5

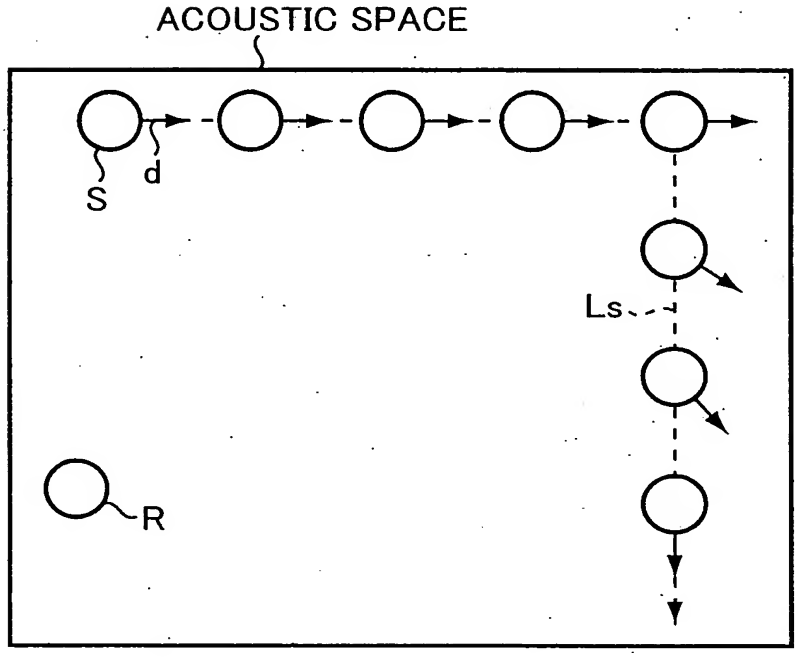


FIG.6

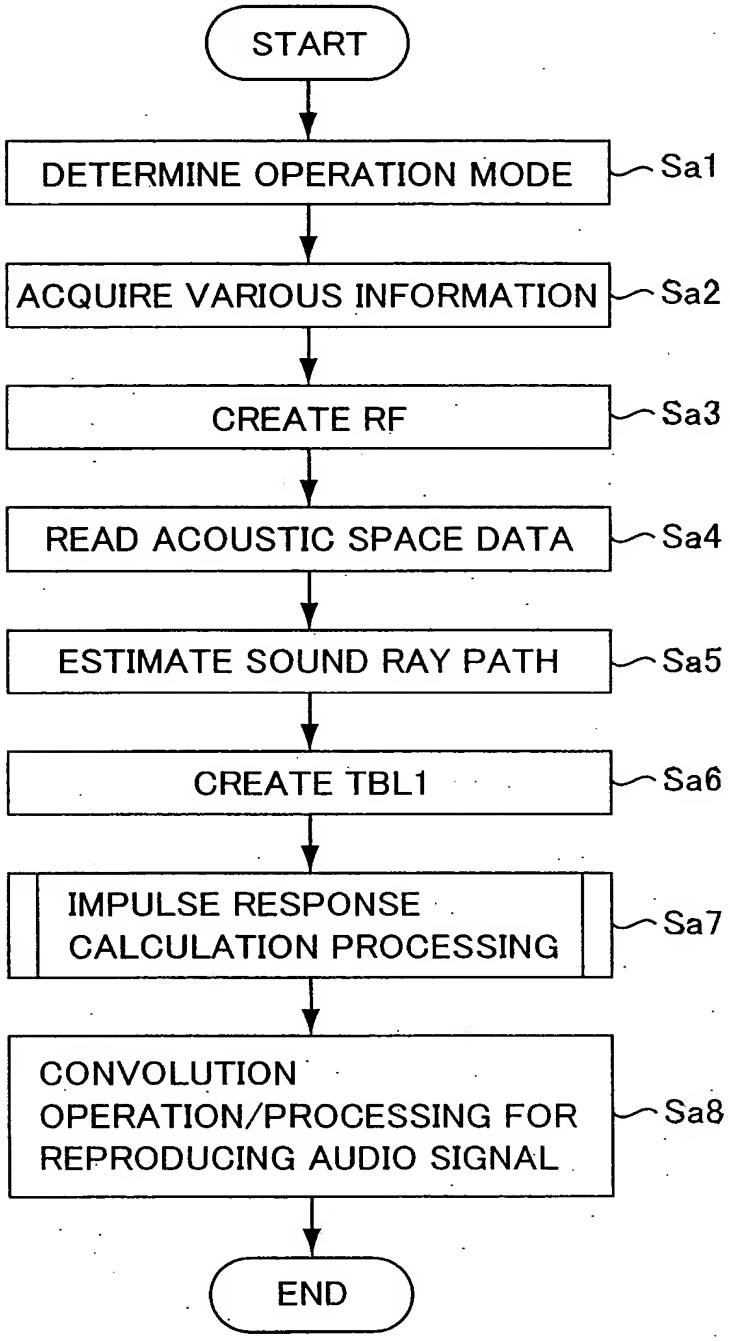

START
DETERMINE OPERATION MODE
Sa1
ACQUIRE VARIOUS INFORMATION
Sa2
CREATE RF
Sa3
READ ACOUSTIC SPACE DATA
Sa4
ESTIMATE SOUND RAY PATH
Sa5
CREATE TBL1
Sa6
IMPULSE RESPONSE CALCULATION PROCESSING
Sa7
CONVOLUTION OPERATION/PROCESSING FOR REPRODUCING AUDIO SIGNAL
Sa8
END

FIG.7

RF

ACOUSTIC SPACE	XX CONCERT HALL
KIND OF SOUND GENERATING POINT	TRUMPET
POSITION OF SOUND GENERATING POINT	(X_S, Y_S, Z_S)
ORIENTATION OF SOUND GENERATING POINT	(X_{Sd}, Y_{Sd}, Z_{Sd})
KIND OF SOUND RECEIVING POINT	HUMAN BEING
POSITION OF SOUND RECEIVING POINT	(X_R, Y_R, Z_R)
ORIENTATION OF SOUND RECEIVING POINT	(X_{Rd}, Y_{Rd}, Z_{Rd})
POSITION OF TARGET POINT	(X_T, Y_T, Z_T)

FIG.8

TBL1

SOUND RAY PATH LENGTH	EMITTING DIRECTION	REACHING DIRECTION	NUMBER OF REFLECTIONS	REFLECTION ATTENUATION RATE
L1	(Xr_1, Yr_1, Zr_1)	(Xa_1, Ya_1, Za_1)	1	d_1
L2	(Xr_2, Yr_2, Zr_2)	(Xa_2, Ya_2, Za_2)	2	d_2
• • •	• • •	• • •	• • •	• • •

FIG.9

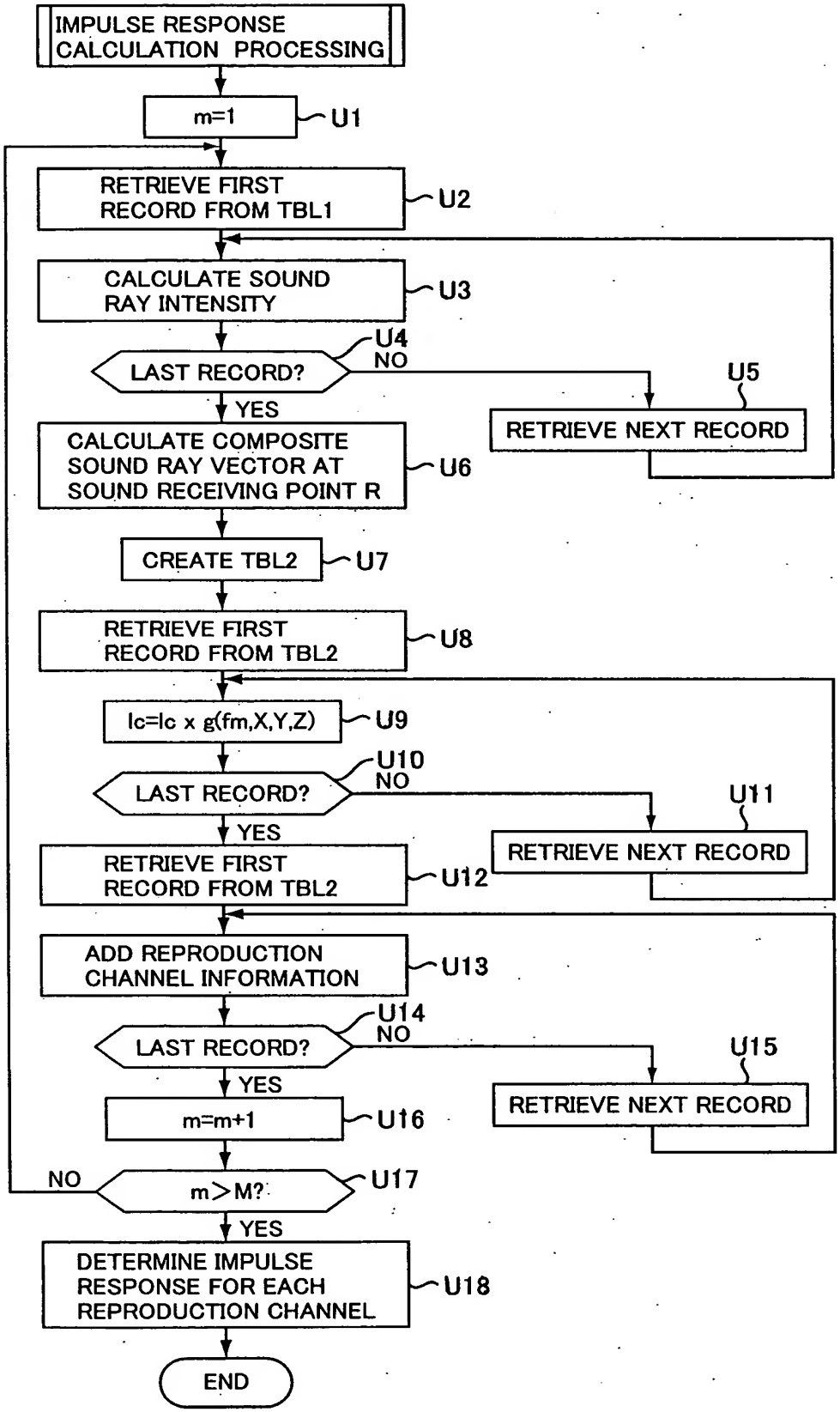

IMPULSE RESPONSE CALCULATION PROCESSING
m=1
U1
RETRIEVE FIRST RECORD FROM TBL1
U2
CALCULATE SOUND RAY INTENSITY
U3
LAST RECORD?
U4
NO
U5
RETRIEVE NEXT RECORD
YES
CALCULATE COMPOSITE SOUND RAY VECTOR AT SOUND RECEIVING POINT R
U6
CREATE TBL2
U7
RETRIEVE FIRST RECORD FROM TBL2
U8
Ic=Ic x g(fm,X,Y,Z)
U9
LAST RECORD?
U10
NO
U11
RETRIEVE NEXT RECORD
YES
RETRIEVE FIRST RECORD FROM TBL2
U12
ADD REPRODUCTION CHANNEL INFORMATION
U13
LAST RECORD?
U14
NO
U15
RETRIEVE NEXT RECORD
YES
m=m+1
U16
NO
m>M?
U17
YES
DETERMINE IMPULSE RESPONSE FOR EACH REPRODUCTION CHANNEL
U18
END

FIG.10

TBL2

REVERBERATION DELAY TIME	COMPOSITE SOUND RAY INTENSITY	COMPOSITE REACHING DIRECTION
3msec	Ic_1	(Xc_1, Yc_1, Zc_1)
3.2msec	Ic_2	(Xc_2, Yc_2, Zc_2)
•	•	•
•	•	•
•	•	•

FIG.11

TBL2

REVERBERATION DELAY TIME	COMPOSITE SOUND RAY INTENSITY	COMPOSITE REACHING DIRECTION	REPRODUCTION CHANNEL INFORMATION
3msec	Ic_1	(Xc_1, Yc_1, Zc_1)	REPRODUCTION CHANNEL[1]
3.2msec	Ic_2	(Xc_2, Yc_2, Zc_2)	REPRODUCTION CHANNEL[3]
•	•	•	•
•	•	•	•
•	•	•	•

FIG.12

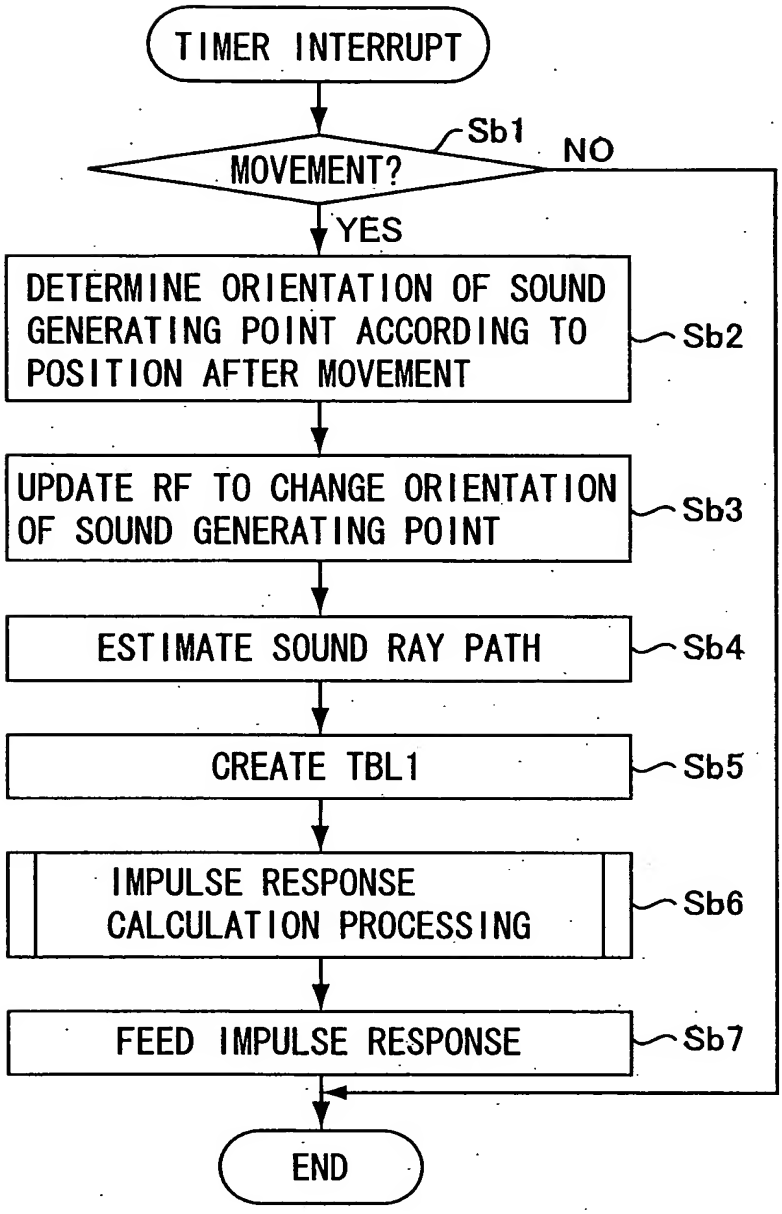
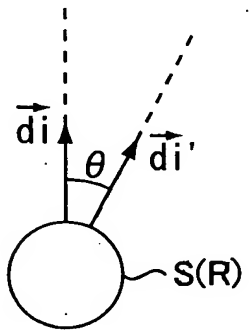

TIMER INTERRUPT
MOVEMENT?
Sb1
NO
YES
DETERMINE ORIENTATION OF SOUND GENERATING POINT ACCORDING TO POSITION AFTER MOVEMENT
Sb2
UPDATE RF TO CHANGE ORIENTATION OF SOUND GENERATING POINT
Sb3
ESTIMATE SOUND RAY PATH
Sb4
CREATE TBL1
Sb5
IMPULSE RESPONSE CALCULATION PROCESSING
Sb6
FEED IMPULSE RESPONSE
Sb7
END

FIG.13


di
θ
di'
S(R)